

How to Write Good (and useful) Physics Problems

There is a school of physics instruction that believes the important thing is to get the right answer, no matter how you get there. I believe that this can be useful for some students, but for many of us, it only encourages sloppy thinking, and can sometimes lead to the problem that one gets to the right end point without really understanding how one got there, or what the implications of getting there are.

I believe that a well-written physics problem is akin to a well-written short essay in a humanities class. It has an introduction, a body, and a conclusion. Following the steps I recommend below will help hone your thinking skills and will better prepare you for dealing with an unfamiliar problem in, say, an exam situation. Furthermore, your solutions will form a useful archive for you to return to when reviewing – you will be much better able to decipher what you were thinking when you wrote it. (You'll also remember better what you did the first time.)

Not all of these steps will be relevant for every single problem, of course. They are meant as a set of guidelines, not a procedure to follow unthinkingly.

1. Restate the problem and explain what you intend to do to solve it. Address why you think the problem was assigned.
2. Draw a picture. Clearly label relevant aspects.
3. Make sure all variables are clearly defined. If they are not in the picture, define them explicitly in the text. Don't assume things like the direction of \hat{x} are obvious.
4. Clearly identify relevant assumptions and axioms that your work depends on.
5. Show your derivation clearly. Annotate with comments to explain steps. The reader should be able to follow it like a conversation.
6. Clearly indicate your answer.
7. Perform sanity checks on your answer. Remember the unit and limit gorillas.
8. Comment on the implications of your answer. What would happen if the answer were different? How were your assumptions important? What did you learn from doing this?

Physics homework is meant to help you understand the principles and phenomena of the world around you, but sometimes the pressure of class can make it feel like you're learning the physics in order to get through the homework, and not the other way around. Following this approach to your homework will help you keep the priorities in mind. It may feel like more work, but (a) these are steps you should be going through anyway, so you might as well be explicit about it, and (b) these steps yield much more legible and easy to read documents. It's much harder to let yourself get away with half-truths and guesswork. In the end, you'll find it's good training for analysis and communication.